

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)}$	I_D $T_A = +25^\circ C$
-60V	390m Ω @ $V_{GS} = -10V$	-2.3A
	595m Ω @ $V_{GS} = -4.5V$	-1.9A

Description and Applications

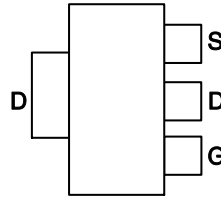
This MOSFET is designed to minimize the on-state resistance and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Motor Control
- DC-DC Converters
- Power Management Functions
- Uninterrupted Power Supply

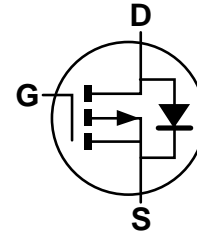
SOT223



Top View



Pin Out - Top View



Equivalent Circuit

Features and Benefits

- Fast Switching Speed
- Low Gate Drive
- Low Input Capacitance
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Mechanical Data

- Case: SOT223
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram Below
- Terminals: Finish - Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.112 grams (Approximate)

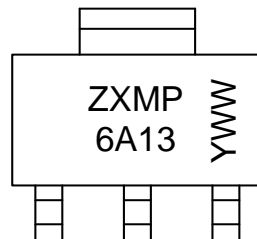
Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMP6A13GTA	ZXMP6A13	7	12	1,000

- Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
 4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information

SOT223



ZXMP 6A13 = Product Type Marking Code
 YWW = Date Code Marking
 Y or \bar{Y} = Last Digit of Year (ex: 5= 2015)
 WW or $\bar{W}W$ = Week Code (01-53)

Maximum Ratings (@T_A = +25°C unless otherwise specified.)

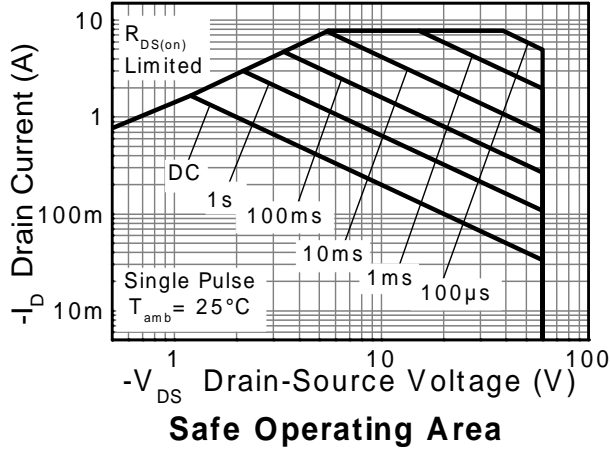
Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V _{DSS}	-60	V
Gate-Source Voltage			V _{GS}	±20	V
Continuous Drain Current	V _{GS} = 10V	(Note 6)	I _D	-2.3	A
		T _A = +70°C (Note 6)		-1.9	
		(Note 5)		-1.7	
Pulsed Drain Current	V _{GS} = 10V	(Note 7)	I _{DM}	-7.8	A
Continuous Source Current (Body Diode)			I _S	-4.1	A
Pulsed Source Current (Body Diode)			I _{SM}	-7.8	A

Thermal Characteristics (@T_A = +25°C unless otherwise specified.)

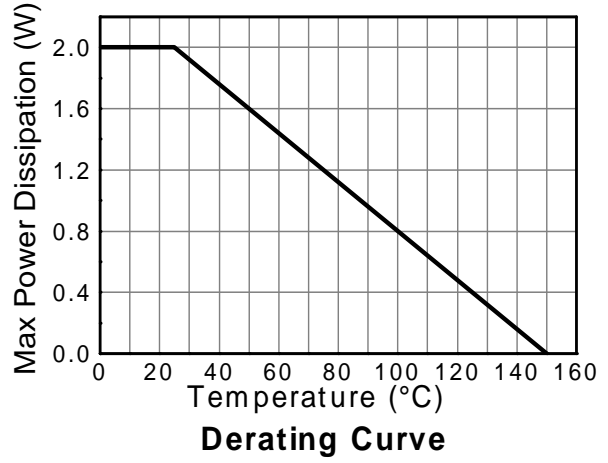
Characteristic			Symbol	Value	Unit
Power Dissipation Linear Derating Factor		(Note 5)	P _D	2.0	W mW/°C
		(Note 6)		16	
Thermal Resistance, Junction to Ambient		(Note 5)		62.5	
		(Note 6)		32.0	
Thermal Resistance, Junction to Lead		(Note 8)	R _{θJA}	9.8	°C/W
Operating and Storage Temperature Range			T _J , T _{STG}	-55 to 150	°C

- Notes:
5. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
 6. Same as Note 5, except the device is measured at t ≤ 10 sec.
 7. Same as Note 5, except the device is pulsed with D = 0.02 and pulse width 300µs. The pulse current is limited by the maximum junction temperature.
 8. Thermal resistance from junction to solder-point (at the end of the drain lead).

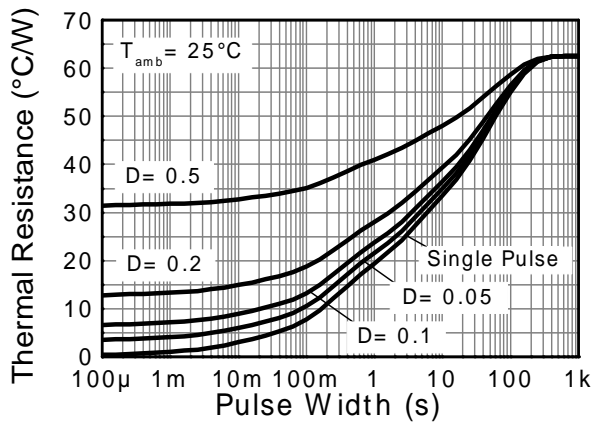
Thermal Characteristics



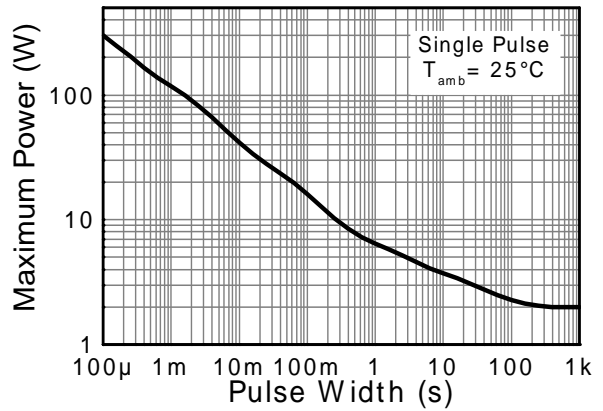
Safe Operating Area



Derating Curve



Transient Thermal Impedance



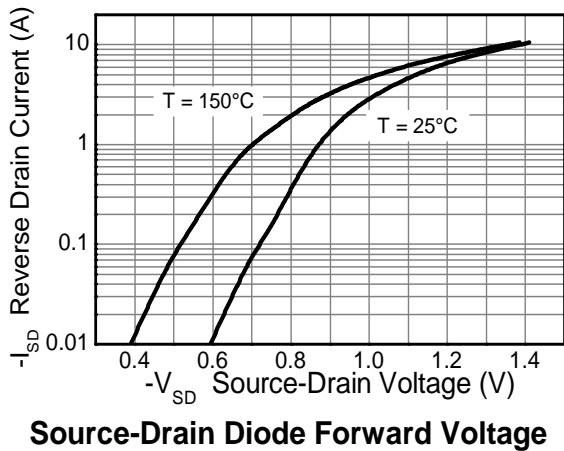
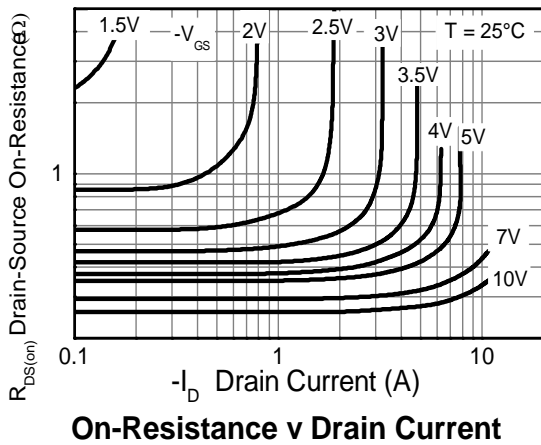
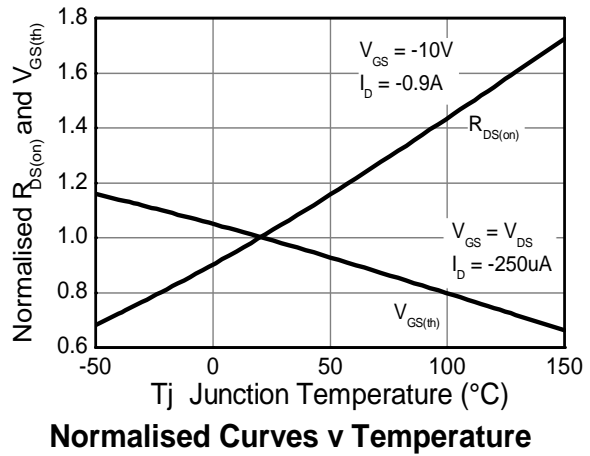
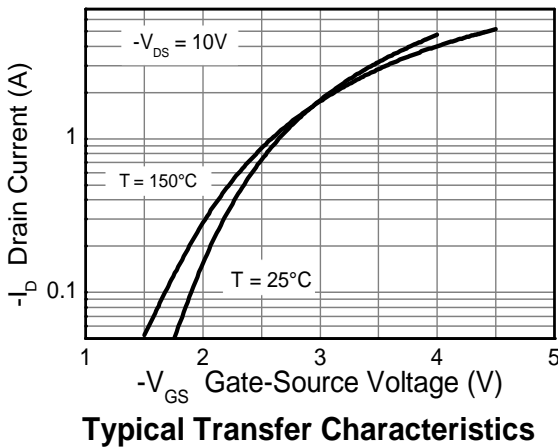
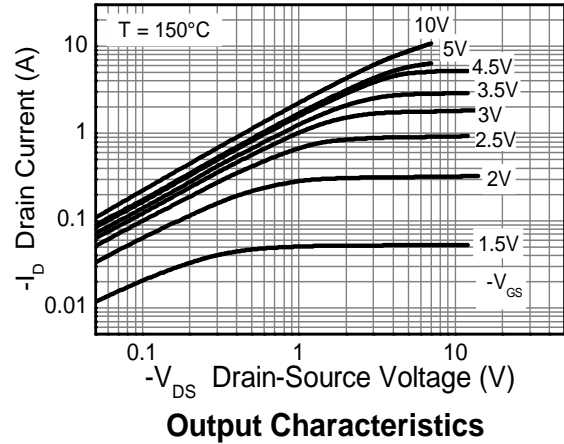
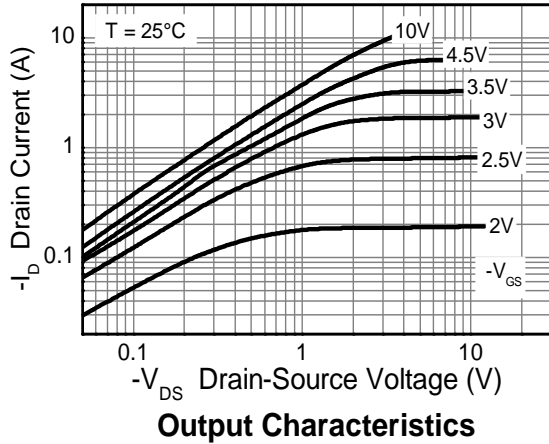
Pulse Power Dissipation

Electrical Characteristics (@T_A = +25°C unless otherwise specified.)

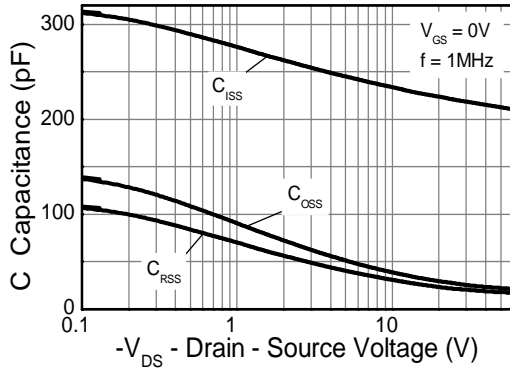
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	-60	—	—	V	I _D = -250μA, V _{GS} = 0V	
Zero Gate Voltage Drain Current	I _{DSS}	—	—	-0.5	μA	V _{DS} = -60V, V _{GS} = 0V	
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V	
ON CHARACTERISTICS							
Gate Threshold Voltage	V _{GS(th)}	-1.0	—	-3.0	V	I _D = -250μA, V _{DS} = V _{GS}	
Static Drain-Source On-Resistance (Note 9)	R _{DS(on)}	—	—	0.390	Ω	V _{GS} = -10V, I _D = -0.9A	
				0.595		V _{GS} = -4.5V, I _D = -0.8A	
Forward Transconductance (Notes 9 & 10)	g _{fs}	—	1.8	—	S	V _{DS} = -15V, I _D = -0.9A	
Diode Forward Voltage (Note 9)	V _{SD}	—	-0.85	-0.95	V	I _S = -0.8A, V _{GS} = 0V, T _J = +25°C	
Reverse Recovery Time (Note 10)	t _{rr}	—	21.1	—	ns	I _S = -0.9A, di/dt = 100A/μs,	
Reverse Recovery Charge (Note 10)	Q _{rr}	—	19.3	—	nC	T _J = +25°C	
DYNAMIC CHARACTERISTICS (Note 10)							
Input Capacitance	C _{iSS}	—	219	—	pF	V _{DS} = -30V, V _{GS} = 0V f = 1MHz	
Output Capacitance	C _{oss}	—	25.7	—	pF		
Reverse Transfer Capacitance	C _{rSS}	—	20.5	—	pF		
Total Gate Charge (Note 11)	Q _g	—	2.9	—	nC	V _{GS} = -4.5V	V _{DS} = -30V I _D = -0.9A
Total Gate Charge (Note 11)	Q _g	—	5.9	—	nC	V _{GS} = -10V	
Gate-Source Charge (Note 11)	Q _{gs}	—	0.74	—	nC		
Gate-Drain Charge (Note 11)	Q _{gd}	—	1.5	—	nC		
Turn-On Delay Time (Note 11)	t _{D(on)}	—	1.6	—	ns	V _{DD} = -30V, V _{GS} = -10V I _D = -1A, R _G ≅ 6.0Ω	
Turn-On Rise Time (Note 11)	t _r	—	2.2	—	ns		
Turn-Off Delay Time (Note 11)	t _{D(off)}	—	11.2	—	ns		
Turn-Off Fall Time (Note 11)	t _f	—	5.7	—	ns		

- Notes:
9. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
 10. For design aid only, not subject to production testing.
 11. Switching characteristics are independent of operating junction temperatures.

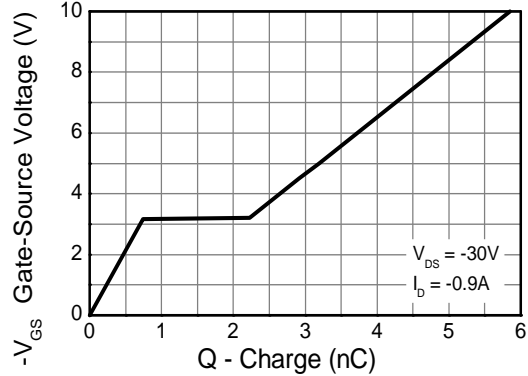
Typical Characteristics



Typical Characteristics (cont.)

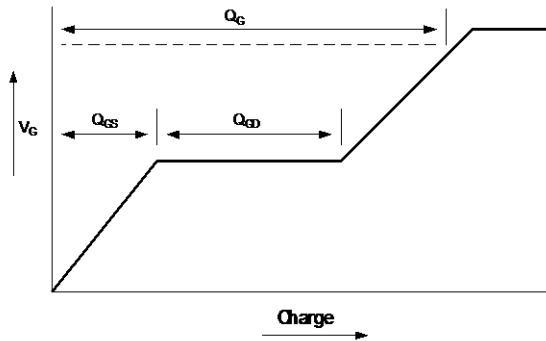


Capacitance v Drain-Source Voltage

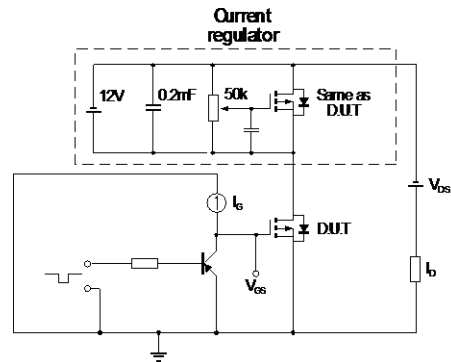


Gate-Source Voltage v Gate Charge

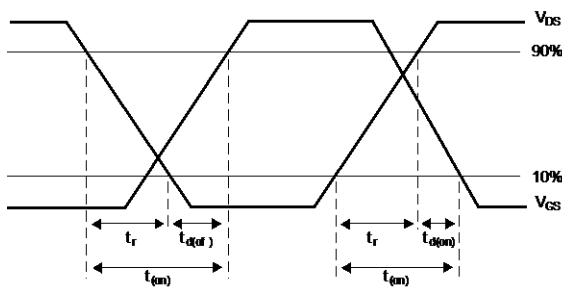
Test Circuits



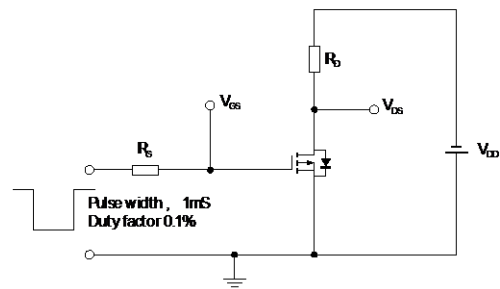
Basic gate charge waveform



Gate charge test circuit



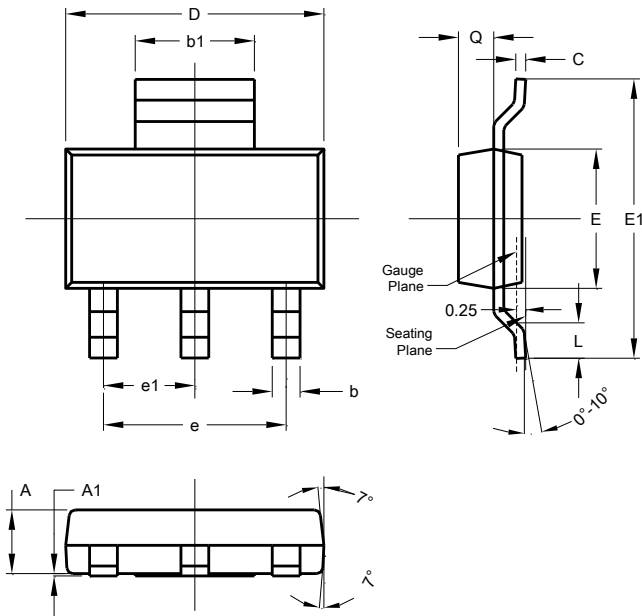
Switching time waveforms



Switching time test circuit

Package Outline Dimensions

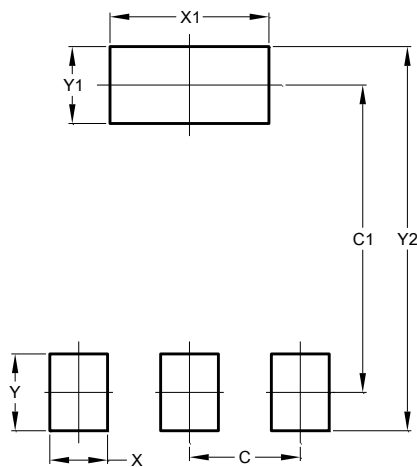
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



SOT223			
Dim	Min	Max	Typ
A	1.55	1.65	1.60
A1	0.010	0.15	0.05
b	0.60	0.80	0.70
b1	2.90	3.10	3.00
C	0.20	0.30	0.25
D	6.45	6.55	6.50
E	3.45	3.55	3.50
E1	6.90	7.10	7.00
e	-	-	4.60
e1	-	-	2.30
L	0.85	1.05	0.95
Q	0.84	0.94	0.89
All Dimensions in mm			

Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



Dimensions	Value (in mm)
C	2.30
C1	6.40
X	1.20
X1	3.30
Y	1.60
Y1	1.60
Y2	8.00

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